EXCELLENCE FROM TECHNOLOGY: THE ROLLS-ROYCE TRENT ENGINE

THE 18TH ANNUAL SIR BERNARD CROSSLAND LECTURE

with Professor Frank Kirkland
Chief Designer, Civil Aerospace, Rolls-Royce

Tuesday 19 February 2019

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WELCOME

PROFESSOR IAN GREER

President and Vice-Chancellor
Queen's University Belfast

Tuesday 19 February 2019

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WELCOME AND INTRODUCTION

PROFESSOR MARK PRICE

Pro-Vice-Chancellor
Faculty of Engineering and Physical Sciences
Queen's University Belfast

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EXCELLENCE FROM TECHNOLOGY: THE ROLLS-ROYCE TRENT ENGINE

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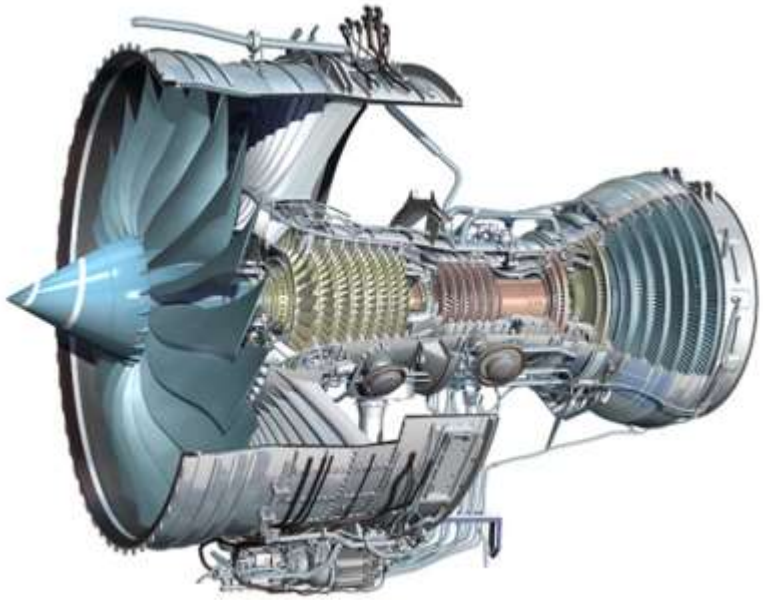
The Rolls-Royce Trent Engine: Excellence from Technology

Frank Kirkland

19th Feb 2019



Trusted to deliver excellence

Rolls-Royce

Sir Bernard Crossland & Rolls-Royce

- Bernard Crossland was born in London
- Started an Apprenticeship with Rolls-Royce in Derby in 1940
- Worked as a Technical Assistant in the Experimental Vibration Department leaving in 1945.

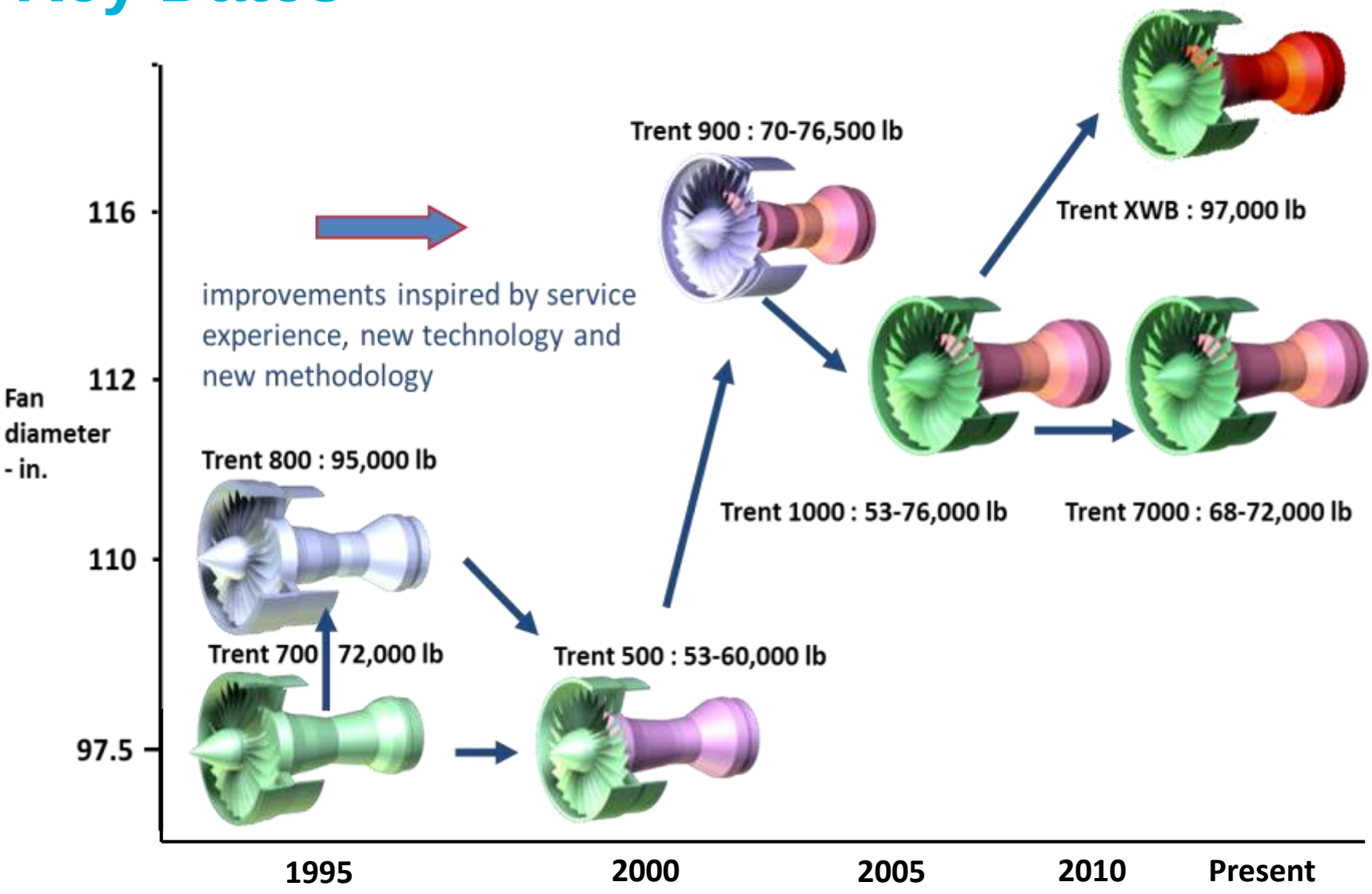
Rolls-Royce

Contents

- Sir Bernard Crossland & Rolls-Royce
- Development of Trent Engines to date.
- Competitive position.
- Technologies.
- Challenges.
- The future.

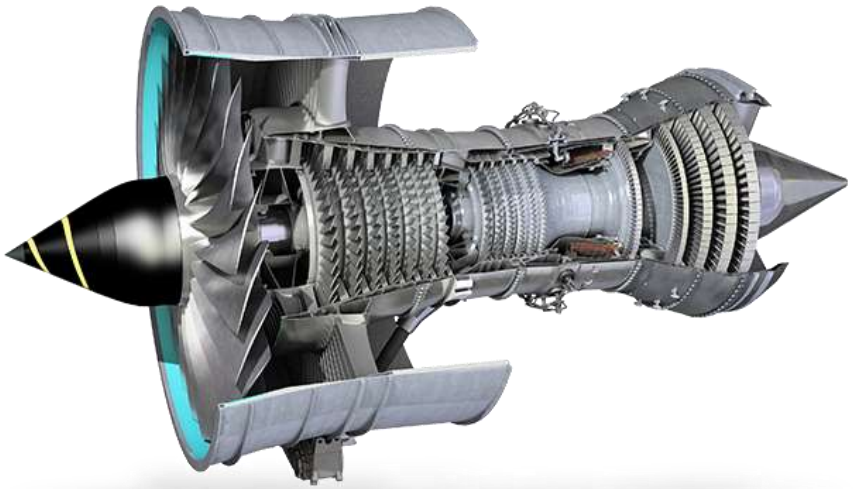
Rolls-Royce

Key Dates



Rolls-Royce

-524



RB211-524G/H & T for the Boeing 747, 767

Entry into Service: 1989 (G)

2%

Lower fuel burn for the Boeing 747-400

40%

Lower NOx emissions from the Trent-style combustor

27,500 hrs+

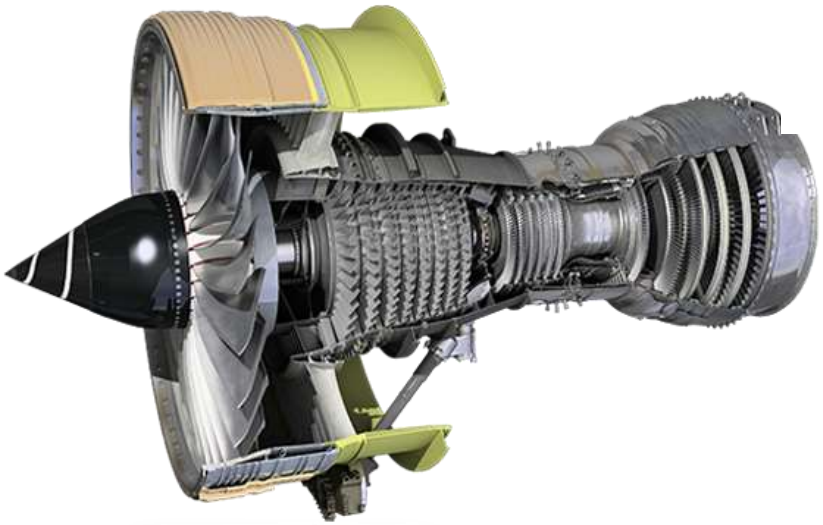
On-wing, the first engine to ever achieve this

49m+

Flying hours, across 7 million flight cycles

Rolls-Royce

Trent 700



Trent 700 for the Airbus A330 family

Certified: Jan 1994

Entry into Service: Mar 1995

50 m hours

40,090

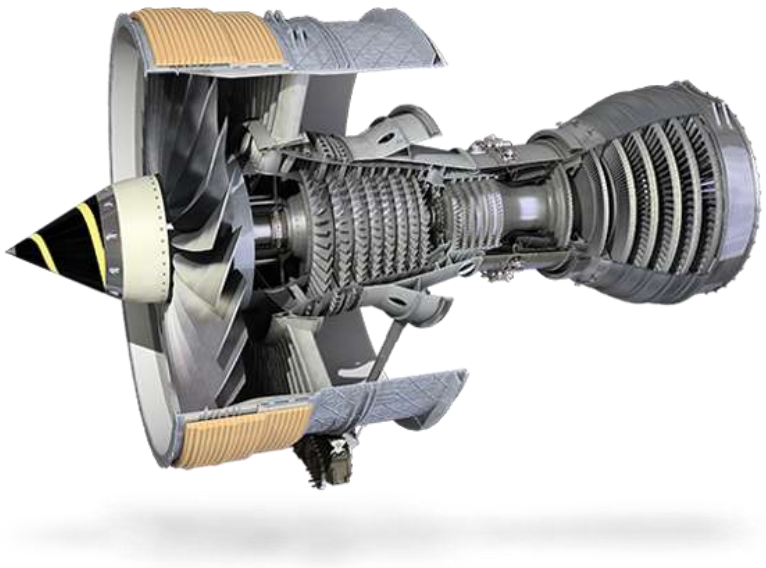
Hours on-wing without a shop visit

470,000

Service hours every month

Rolls-Royce

Trent 800



Trent 800 for the Boeing 777 family

Certified: Jan 1995

Entry into Service: Mar 1996

27M
Flying hours

5M
Flying cycles of Trent 800 operation achieved

8,000
Pounds lighter than a Boeing 777 powered by heavier competing engines

$200K
The possible fuel burn savings per aircraft per year from the Trent 800 EP package

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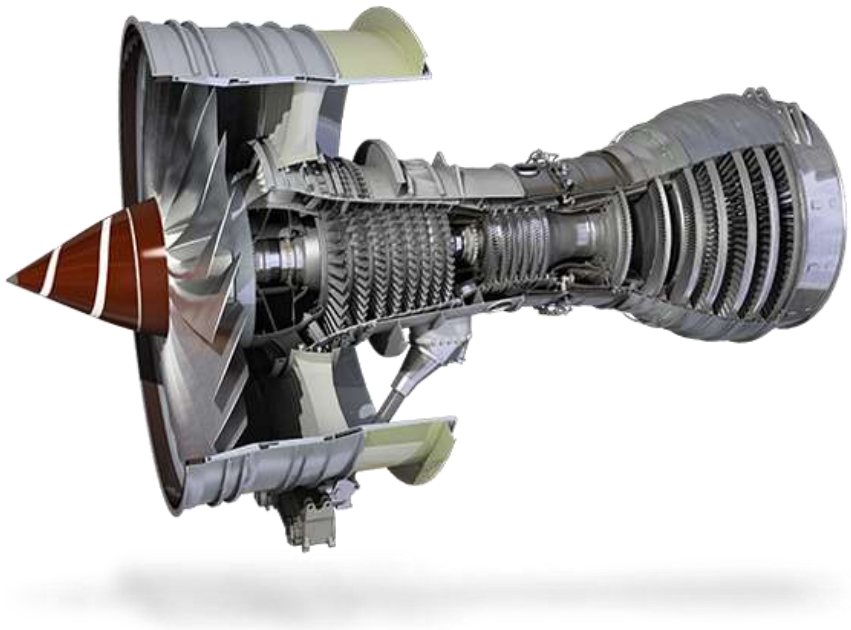
Trent 500



Trent 500 for the Airbus A340 family

Certified: Dec 2000

Entry into Service: Jul 2002

21

Flying hours (million)

60K lb

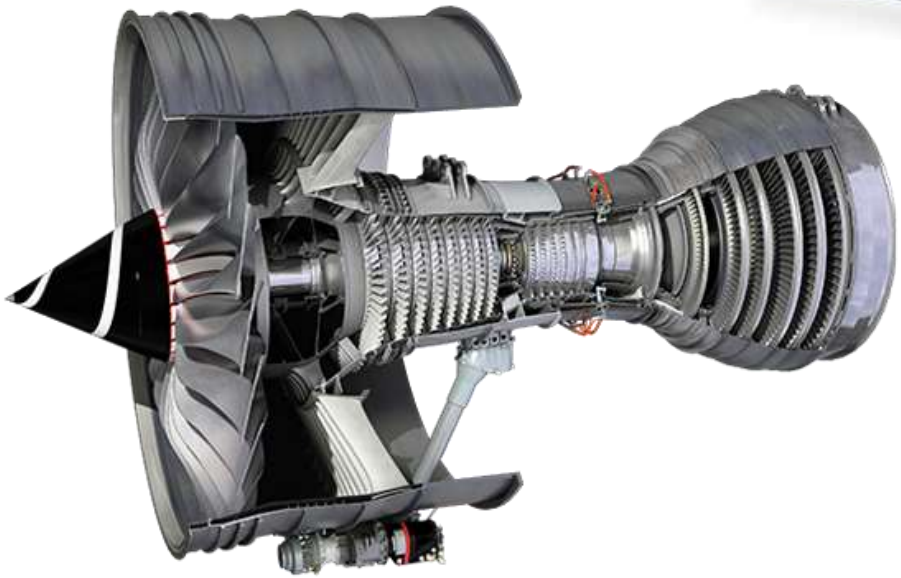
certification; providing longer time on-wing

97.4”

wide-chord fan diameter

Rolls-Royce

Trent 900



Trent 900 for the Airbus A380

Certified: Oct 2004

Entry into Service: Oct 2007

1.6%

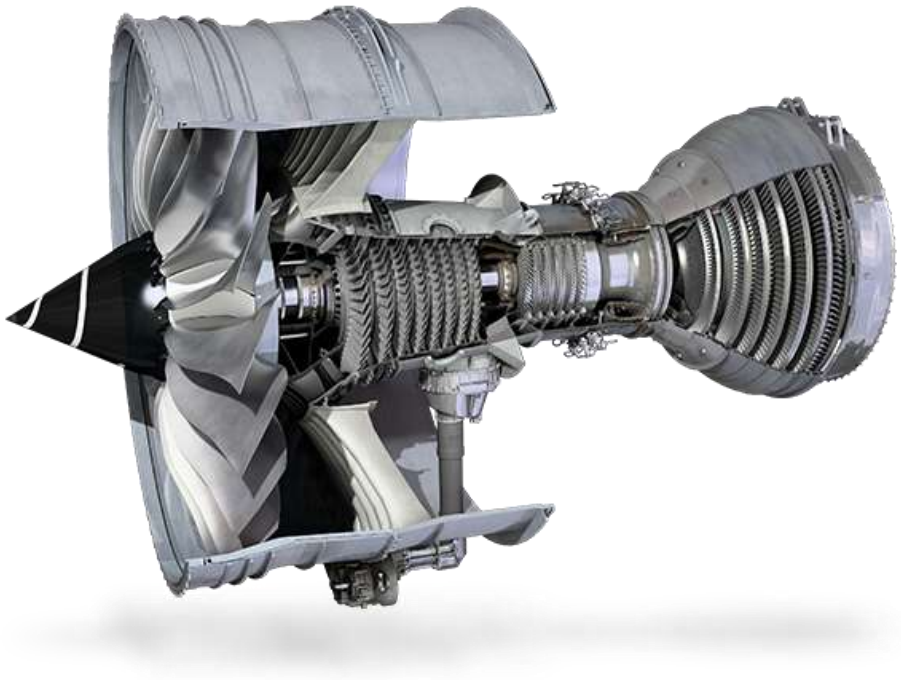
fuel burn improvements since EIS

116”

diameter of advanced swept fan

Rolls-Royce

Trent 1000



Trent 1000 for the Boeing 787 Dreamliner family

Certified: Aug 2007

Entry into Service: Oct 2011

10:1

The highest bypass ratio of any Trent engine

20%

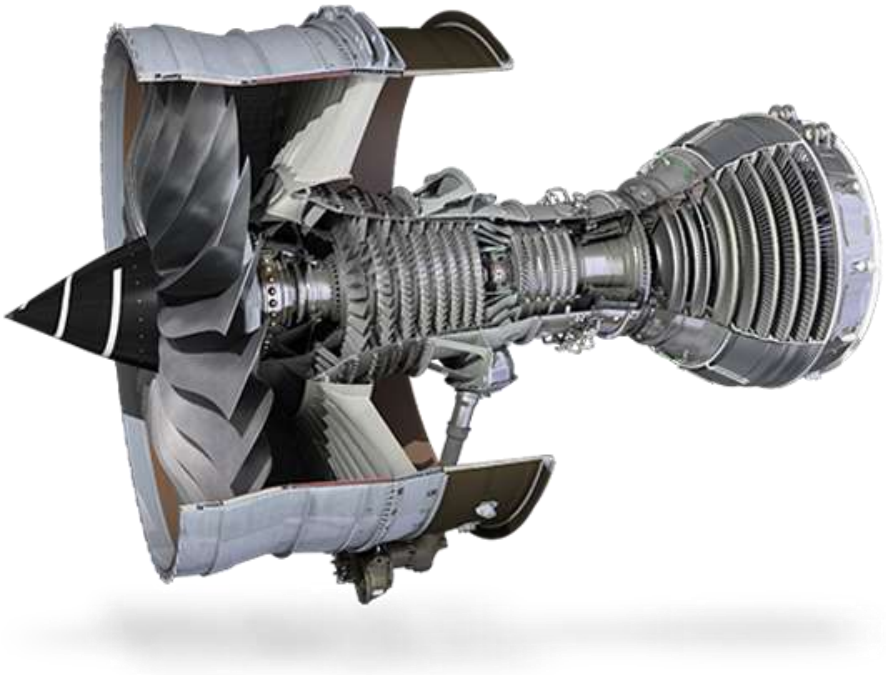
More fuel efficient than the 767 that the Trent 1000-powered 787 replaces

99.9%

Dispatch reliability since EIS

Rolls-Royce

Trent XWB



Trent XWB for the Airbus A350 XWB family

Certified: Sep 14

Entry into Service: Jan 15

15%

Fuel Consumption advantage over the original Trent engine

1600+

Trent XWB engines on order worldwide

$2.9M

Savings per year per aircraft on fuel alone

50,000

Horsepower generated by 68 high pressure turbine blades

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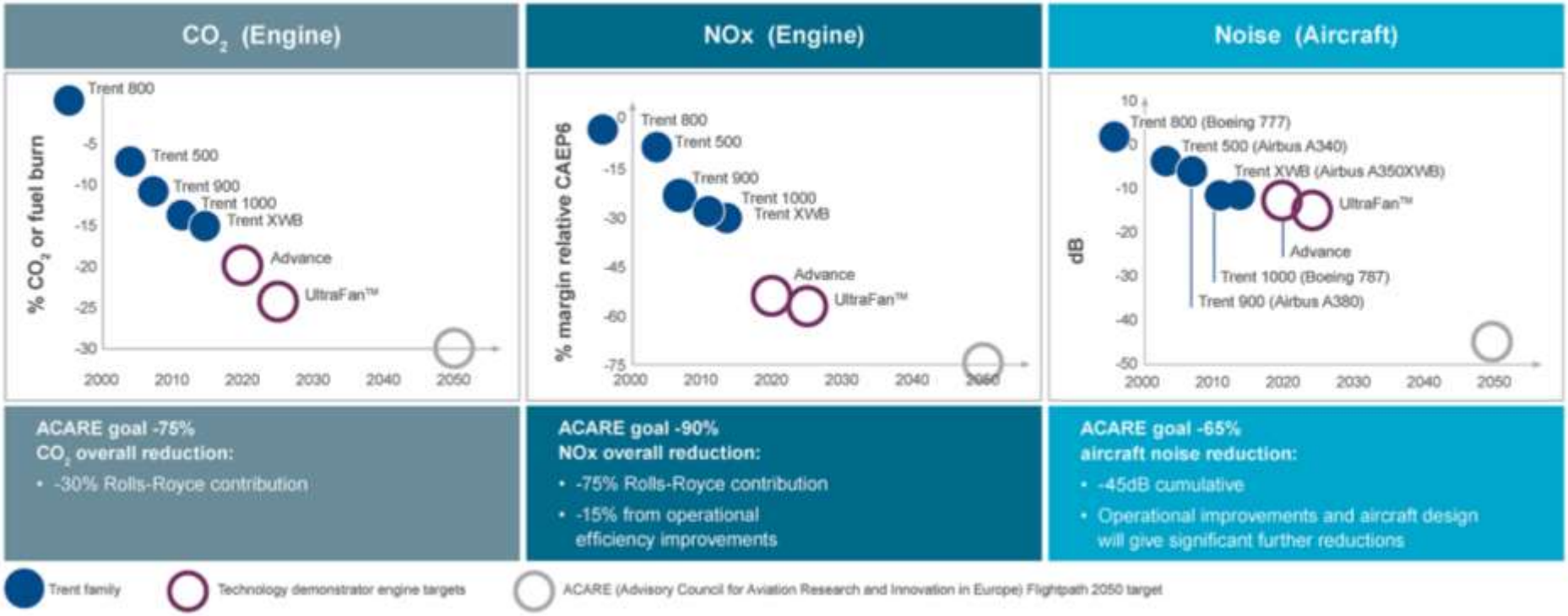
The Environment



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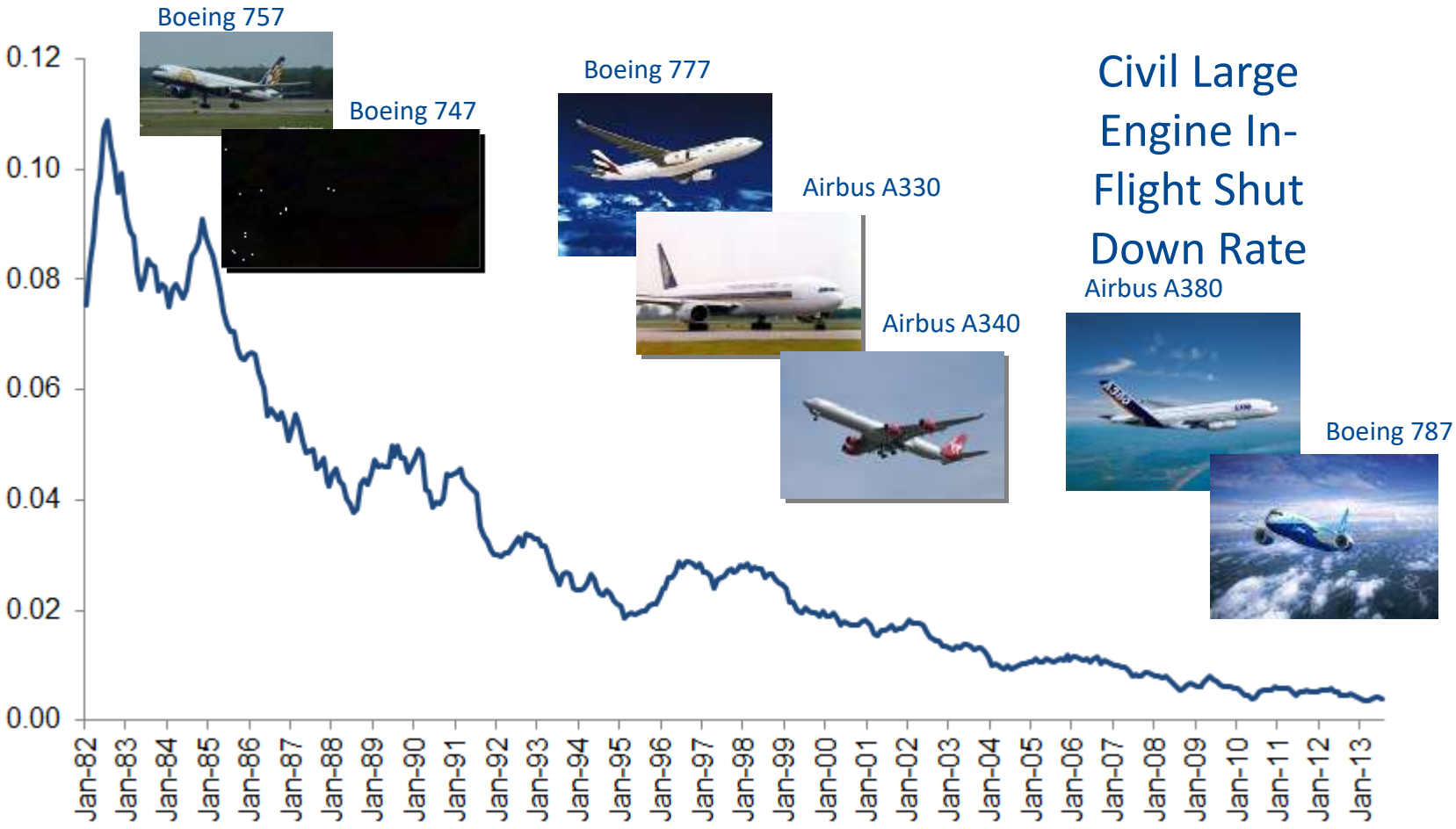
Improving safety and reliability



Per 1000 engine flying hours (12 month average)

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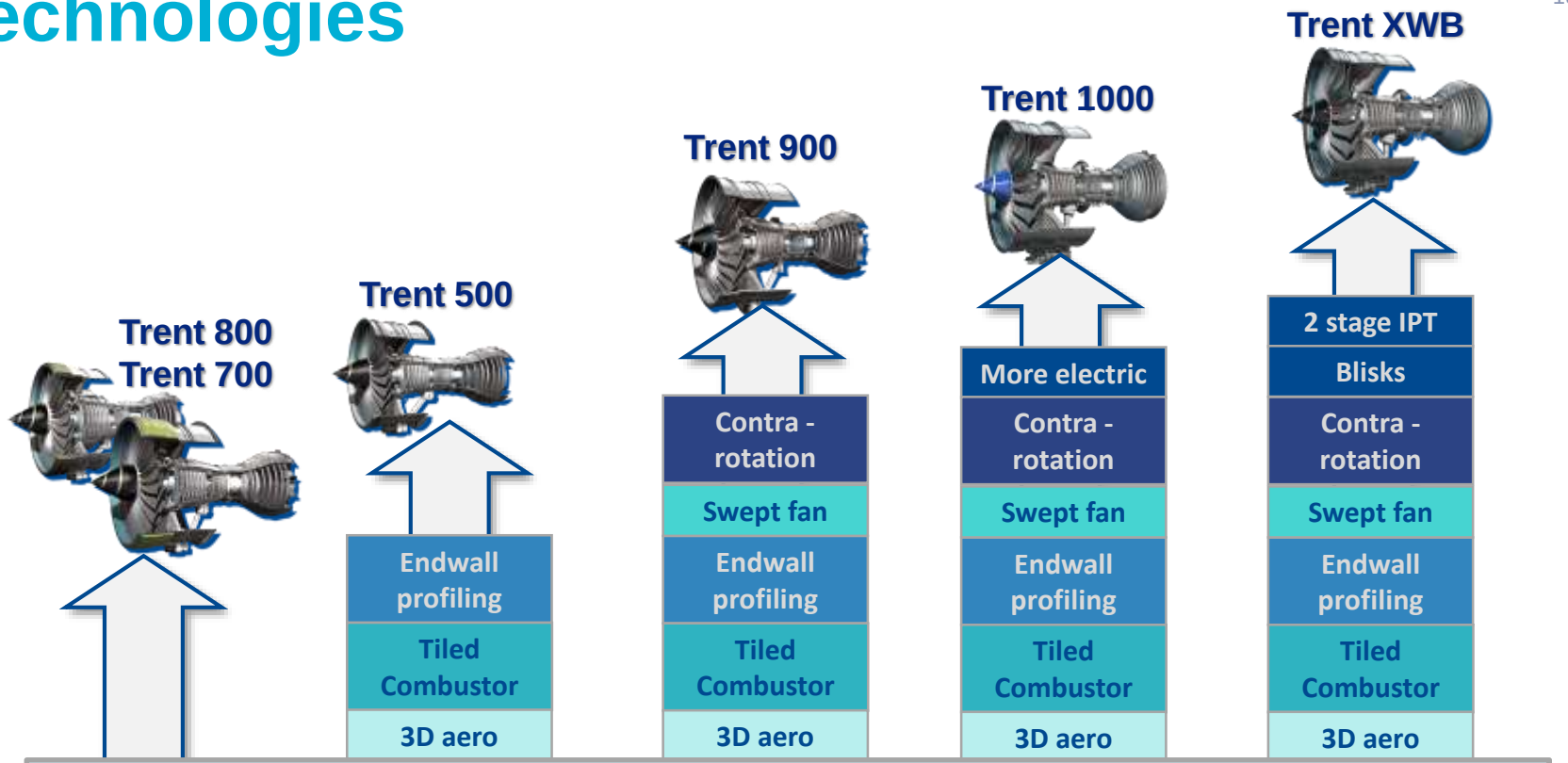
Technologies



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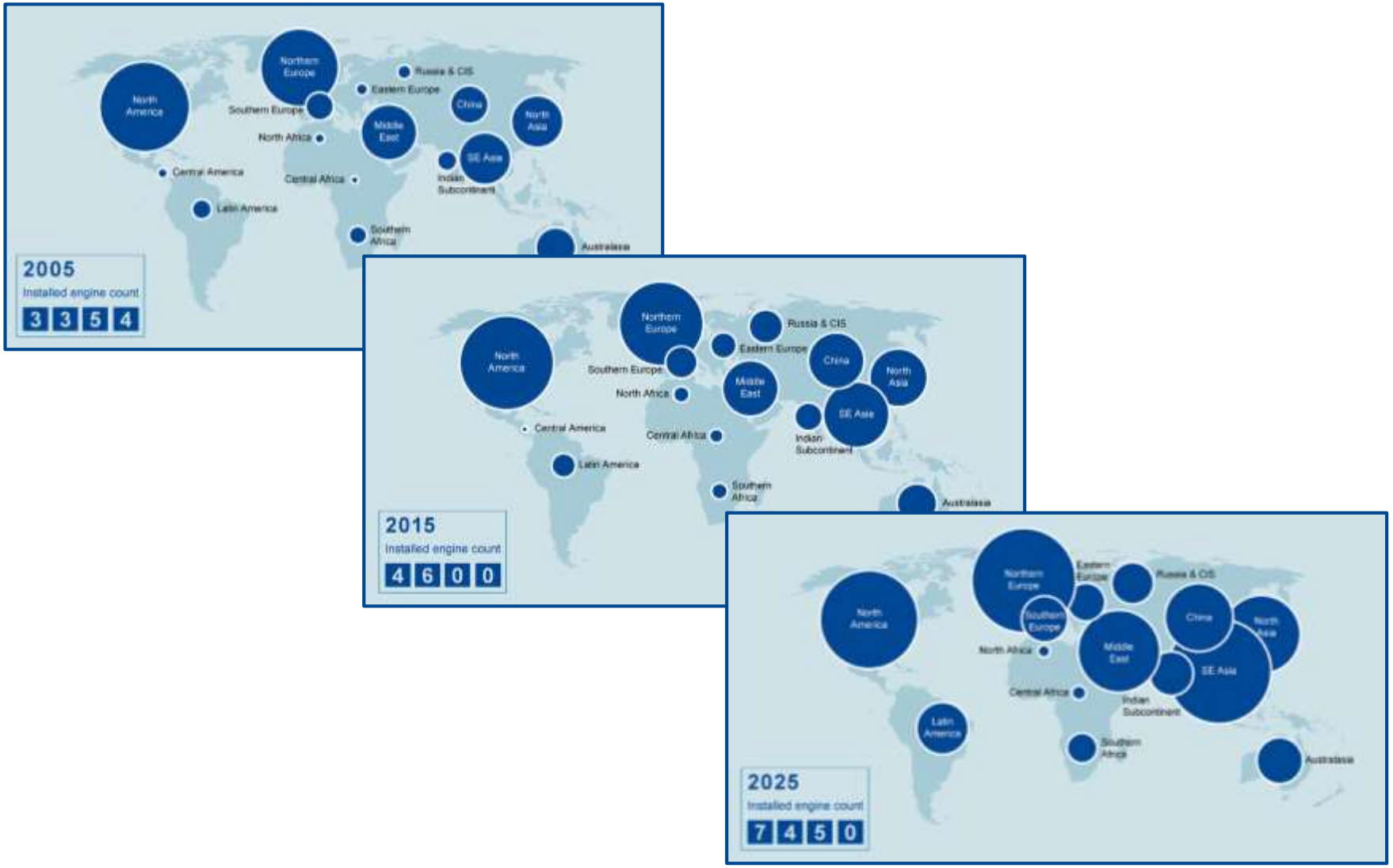
Customers



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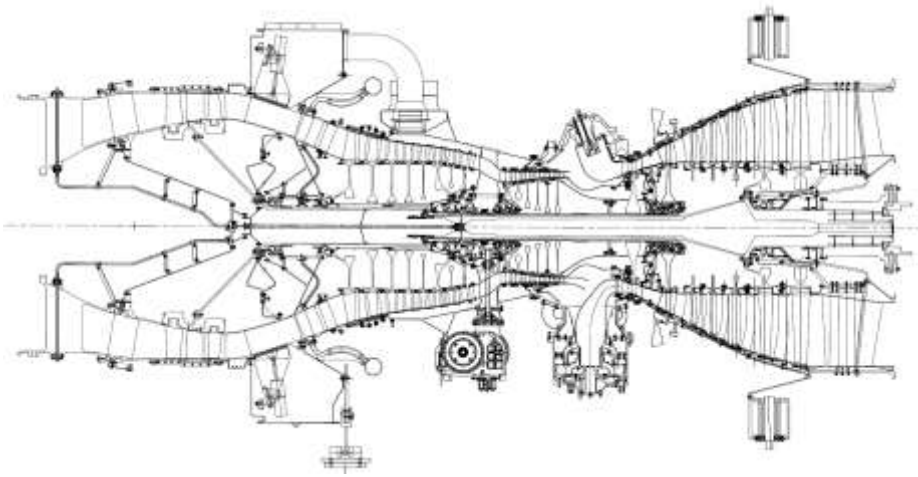
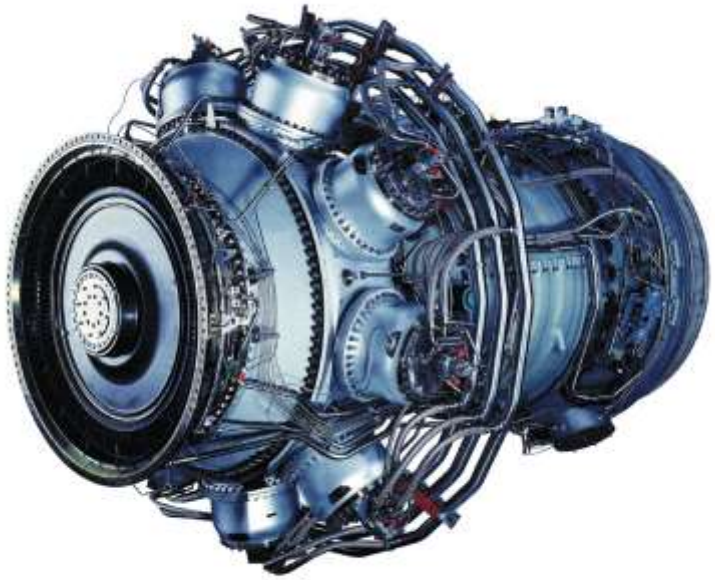
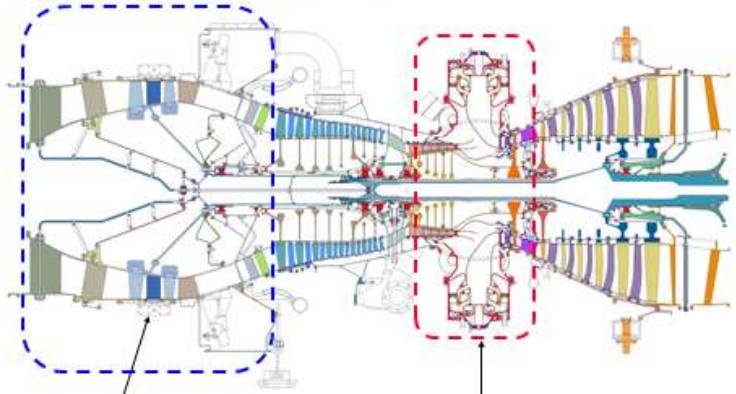
Industrial Trent





Trent 800 Industrialization – Key Features



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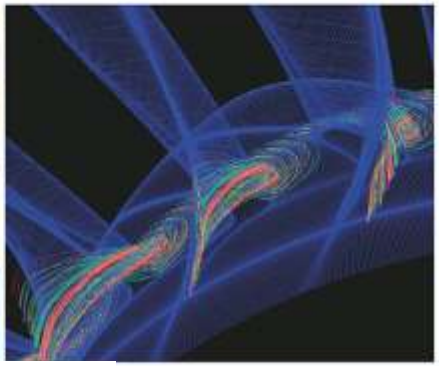
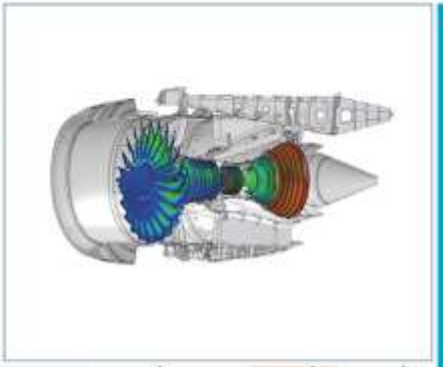
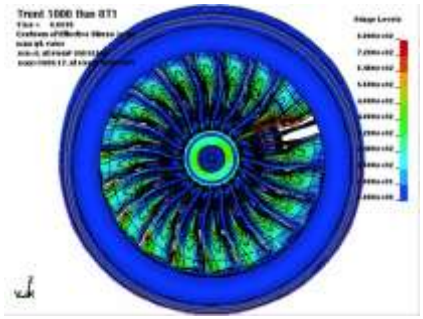
Methods Development – The Virtual Engine







Design and Validate in the Computer Investment (DaVinci) programme

Engineers can experiment with concepts digitally and accurately

Less testing, better quality and lower cost

Introduce products up to a year faster

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Impact

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Trent XWB for the Airbus A350

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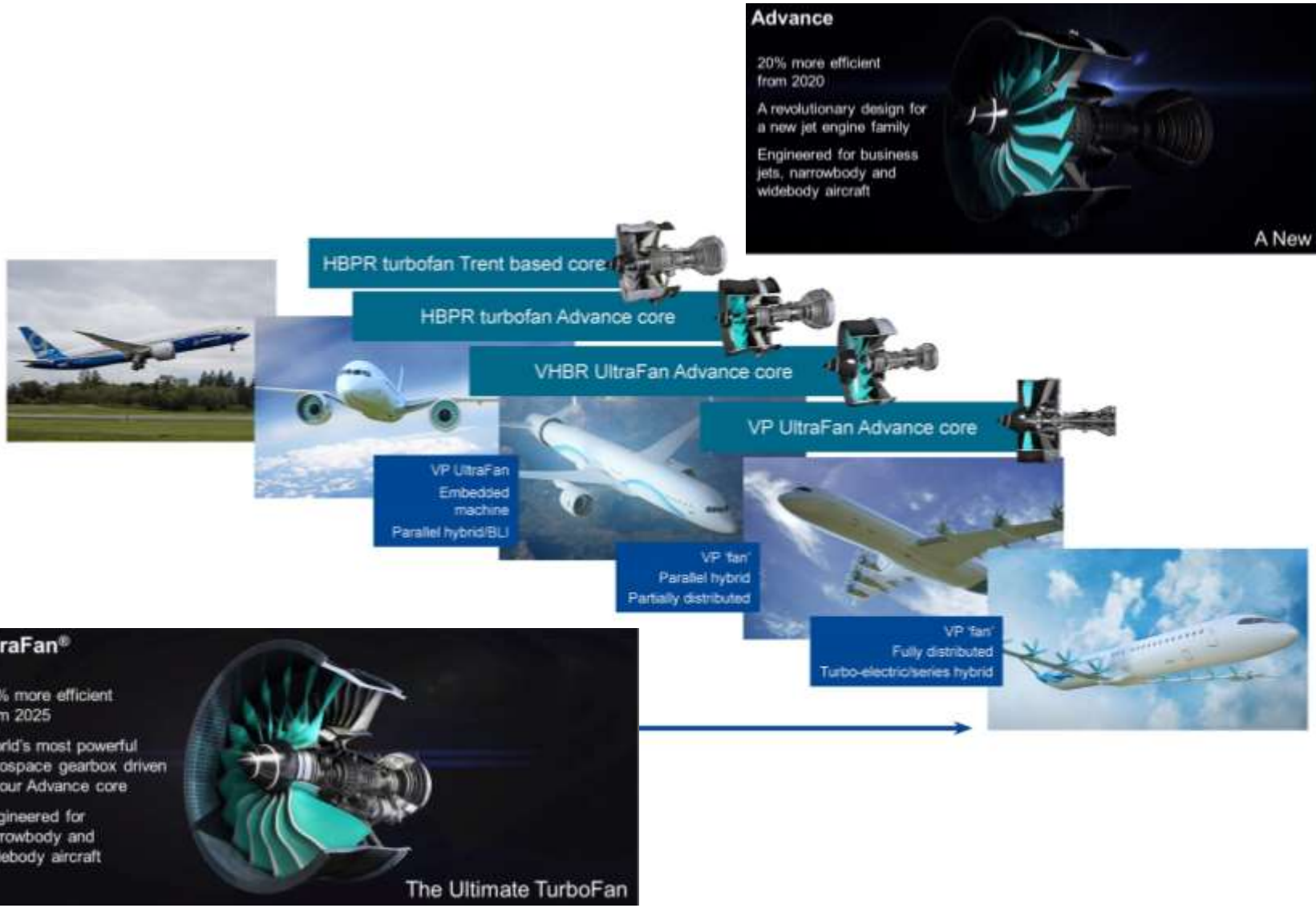
The Future: UltraFan & Advance



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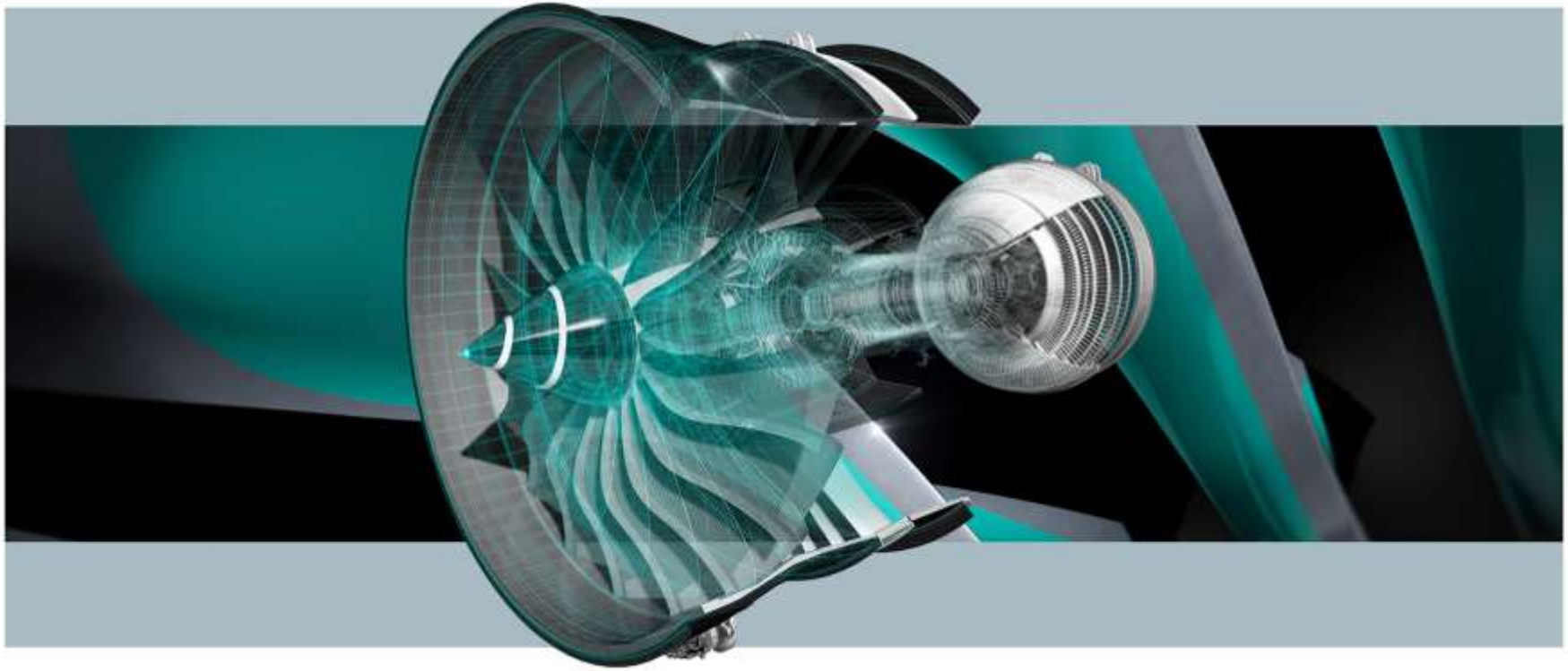
Intelligent innovation in everything we do



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frank.kirkland@rolls-royce.com

QUESTION AND ANSWER

DR ROBERT EADIE

Chair
Engineers Ireland Northern Region

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UPCOMING EVENTS

The Future of Procurement – Learning from Failures *with John Cole*
13th March 2019 at 7pm
Conor Lecture Theatre, Ulster University, Belfast Campus
Joint meeting with the Association from Project Management (APM)

Renewable Gases in Vehicle Transport
27th March 2019 at 6.15am
Room 9F09, Ulster University, Jordanstown Campus
Three speakers will be dealing with the use of Hydrogen powered vehicles in Transport

Norther Region Annual Dinner & Conferring of Titles
29th March 2019 at 6.30pm
Titanic Belfast

Security-minded Digital Engineering and BIM and PAS1192-5
3rd April 2019 at 6.15pm
Conor Lecture Theatre, Ulster University, Belfast Campus
Joint evening lecture with ISturctE

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FINAL REMARKS

MR PETER QUINN

President
Engineers Ireland

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THANK YOU

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